

# Assaying Total Carotenoids in Flours of Corn and Sweetpotato by Laser Photoacoustic Spectroscopy

Svjetlana Luterotti · Dane Bicanic · Kristina Kljak · Darko Grbesa · Eduardo San Martin Martínez · Ruud Spruijt

Published online: 17 July 2010

© The Author(s) 2010. This article is published with open access at Springerlink.com

**Abstract** This study describes the application of the laser photoacoustic spectroscopy (PAS) for quantification of total carotenoids (TC) in corn flours and sweetpotato flours. Overall, thirty-three different corn flours and nine sweetpotato flours were investigated. All PAS measurements were performed at room temperature using 488-nm argon laser radiation for excitation and mechanical

modulation of 9 and 30 Hz. The measurements were repeated within a run and within several days or months. The UV–Vis spectrophotometry was used as the reference method. The concentration range that allows for the reliable analysis of TC spans a region from 1 to 40 mg kg<sup>-1</sup> for corn flours and from 9 to 40 mg kg<sup>-1</sup> for sweetpotato flours. In the case of sweetpotato flours, the quantification may extend even to 240 mg kg<sup>-1</sup> TC. The estimated detection limit values for TC in corn and sweetpotato flours were 0.1 and 0.3 mg kg<sup>-1</sup>, respectively. The computed repeatability ( $n=3-12$ ) and intermediate precision ( $n=6-28$ ) RSD values at 9 and 30 Hz are comparable: 0.1–17.1% and 5.3–14.7% for corn flours as compared with 1.4–9.1% and 4.2–23.0% for sweetpotato flours. Our results show that PAS can be successfully used as a new analytical tool to simply and rapidly screen the flours for their nutritional potential based on the total carotenoid concentration.

This work was presented in part at 6th International Conference: Instrumental Methods of Analysis—Modern Trends and Applications, 4–8 October 2009, Athens, Greece.

This research is partly financed by the research grants of the Ministry of Science, Education and Sports, Republic of Croatia: “Interactions of gallium(III) and iron(III) with antiproliferative drugs” (006-0061117-1243) and “Nutritional, antioxidative and prebiotic attribute of corn for domestic animals” (178-1780496-0368). The authors thank the Faculty of Agronomy, University of Zagreb, for donating some species of corn flours.

S. Luterotti (✉)

Faculty of Pharmacy and Biochemistry, University of Zagreb,  
A. Kovačića 1,  
10000 Zagreb, Croatia  
e-mail: sluter@pharma.hr

D. Bicanic · R. Spruijt

Laboratory of Biophysics, Wageningen University,  
Dreijenlaan 3-Transitorium,  
6703 HA Wageningen, The Netherlands

K. Kljak · D. Grbesa

Faculty of Agronomy, University of Zagreb,  
Svetošimunska 25,  
10000 Zagreb, Croatia

E. S. Martínez

Centro de Investigacion en Ciencia Aplicada  
y Tecnologia Avanzada,  
IPN, Legaria 694, Colonia Irrigacion,  
11500 Mexico, DF, Mexico

**Keywords** Photoacoustic spectroscopy (PAS) ·

Total carotenoids assay · Corn flours · Sweetpotato flours

## Introduction

Photoacoustic spectroscopy (PAS) relies on the indirect measurement of absorbance in the optically thin, as well as in the opaque and light scattering media. This makes PAS a unique method in the comparison with conventional spectroscopy where the specimen’s transparency is an absolute necessity. In addition, PAS is simple to use, requires only a small quantity of sample for analysis, involves a minimum of preparation (samples are studied just as they are), and is also less susceptible to the reflectance and morphology of the sample.